Dietary Factors and Cancer in Israel

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Summary

The risk of developing cancer is relatively higher in the European-born Israeli population than in those originating from the Middle Eastern or North African countries. The majority of cancer sites with a higher risk in the European group involve the gastrointestinal and reproductive systems. Certain leads suggest that at least some of these risk differences may be attributed to diet. Data based on case-control studies are provided; they indicate a high consumption of starches among gastric cancer patients and a lower fiber consumption in patients with cancer of the colon. The latter observations may be extended to cancer of the breast, ovary, and corpus uteri, assuming an interplay between the concentration of bile degradation products and hormone metabolism. Although a low fiber consumption seems a more likely mechanism, a higher fat consumption is also compatible with this model. However, due to the complexity of human nutrition, it seems unwarranted to incriminate any single dietary factor in carcinogenesis. A better understanding of the metabolic pathways, coupled with consistent observations from distinct populations, should be looked for.

The heterogeneous composition of the Israeli population has provided a quite clear demarcation of high- and low-risk cancer groups, which may provide certain leads to the role of environmental factors in carcinogenesis. In this report, an attempt will be made to correlate the descriptive data with the limited observations thus far available on dietary factors in cancer etiology.

Incidence Studies

Table 1 presents a listing of the cancer sites for which a meaningful difference in risk exists between European-born and Asian- or African-born Israelis. The data are based on nationwide morbidity studies performed in our department (7, 14, 24, 25, 27, 29–33, 36) and reports of the Israel Central Cancer Registry (10, 35). The table is limited to foreign-born Jews only, because of the small population size of Arabs and native Jews in older age groups. The reasons for the varying incidence between the ethnic groups are mostly obscure, with the possible exception of malignant melanoma, where a difference in skin pigmentation may play a significant role in differential etiology. However, a majority of sites for which the risk is relatively higher in the European-born group involve the gastrointestinal and the reproductive systems. Certain leads suggest that at least some of these risk differences may be attributed to diet.

Dietary Studies of Gastrointestinal Cancer

Table 2 summarizes the main findings obtained in 2 recent case-control dietary studies of gastrointestinal cancer carried out by us (26, 28). Patients and 1 control group, comprising patients operated on for a nonmalignant, nongastrointestinal disorder, were selected from the surgical wards of 6 hospitals in the Tel Aviv area. A 2nd control group, consisting of persons living in the same neighborhood, was defined through national voting files. Each control was matched to the cancer case on age, sex, ethnic origin, and length of residence in Israel.

Information regarding dietary habits up to 1 year preceding the diagnosis of current illness was obtained by a personal interview. Food consumption was indirectly quantified by the frequency of consumption of each food item. There were 166 cases with gastric cancer, 198 cases with cancer of the colon, and 77 cases with rectal cancer. Sixty-seven % of the patients in the gastric group and 55% in the colorectal group were males, 86% were European born, and 60% of the total had immigrated to Israel before 1950.

The data show a higher consumption of starches in gastric cancer, a lower consumption of fiber in colon cancer, and lack of association with any dietary agent in rectal cancer. Since the 3 sites were studied concurrently by the same method, these results seem to indicate varying etiology in the main cancer sites along the gastrointestinal tract. This is in line with descriptive studies that have demonstrated distinct epidemiological patterns for these disorders, such as geographical distribution, sex ratio, and secular trends (8, 22).

Detailed inspection of the data demonstrated that the differences between the cases and controls were spread out between individuals and not due to a few very large intrapair differences in both gastric and colon cancer. Further analysis revealed that the increased consumption frequency of starches in the gastric cancer patients and the decreased intake of fiber in colon cancer were an overall trend for these food groups and not limited to any particular subgroup or food item. The higher consumption of starches is in line with previous observations of a higher consumption of cereals or potatoes (11, 13, 34) among patients with gastric cancer, but the causal effect of the latter could be questioned in view of the association of this disease with lower...
Table 1

Relatively high-risk cancer sites in foreign-born Israeli Jews by major ethnic origin and sex

<table>
<thead>
<tr>
<th>Sites with higher risk in European and American born</th>
<th>Sites with higher risk in Asian and African born</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>Females</td>
</tr>
<tr>
<td>Lip</td>
<td>Lip</td>
</tr>
<tr>
<td>Salivary gland</td>
<td>Tongue</td>
</tr>
<tr>
<td>Stomach</td>
<td>Stomach</td>
</tr>
<tr>
<td>Small intestine</td>
<td>Lip</td>
</tr>
<tr>
<td>Colon</td>
<td>Colon</td>
</tr>
<tr>
<td>Rectum</td>
<td>Rectum</td>
</tr>
<tr>
<td>Pancreas</td>
<td>Gallbladder</td>
</tr>
<tr>
<td>Breast</td>
<td>Breast</td>
</tr>
<tr>
<td>Testis</td>
<td>Ovary</td>
</tr>
<tr>
<td>Kidney</td>
<td>Kidney</td>
</tr>
<tr>
<td>Melanoma</td>
<td>Melanoma</td>
</tr>
<tr>
<td>Brain</td>
<td>Eye</td>
</tr>
<tr>
<td>Leukemia</td>
<td>Brain</td>
</tr>
<tr>
<td>Nasopharynx</td>
<td>Nasopharynx</td>
</tr>
<tr>
<td>Liver</td>
<td>Larynx</td>
</tr>
<tr>
<td>Gallbladder</td>
<td>Cervix</td>
</tr>
</tbody>
</table>

Data are based on studies referred to in text and data of the Central Cancer Registry. Site has been considered as high risk if age-adjusted rate was at least 50% higher (world population used for standardization).

The theoretical basis for an association between starch consumption and gastric cancer remains open to speculation. On the other hand, the lower frequency of fiber consumption in cancer of the colon is compatible with the recent hypothesis relating the geographical differences in the incidence of this disease to a decreased consumption of foods with high fiber content in modern society (3, 5). The possible carcinogenic mechanism is attributed to a more concentrated fecal mass, decreased intestinal transit time, the composition of intestinal flora, and a higher concentration of biliary end products (4, 16, 17).

It remains to be explored whether analogous differences in dietary patterns exist between healthy European and non-European Israeli residents, which might explain the higher risk of both gastric and colon cancer in the former group. Unfortunately, currently available data on comparative dietary patterns of the respective population groups are only fragmentary and are of questionable reliability.

Hypotheses Concerning Other Cancer Sites

Although direct evidence is not yet available, circumstantial evidence implicates diet in the role of other types of cancer as well. Consequently, differential dietary patterns may contribute to a certain extent to the relatively higher risk of some of the cancer sites enumerated above in the European-born Israeli subjects, compared with those of Asian and African extraction. Perhaps the most intriguing lead is the striking similarity in the population distribution of breast and colon cancer, which suggests a common etiological and pathogenetic mechanism. Additional supportive evidence for a possible role of diet in breast cancer is provided by the differential age-specific incidence curve in high- and low-risk populations. In this context the Israeli data (33, 35) are in line with those reported for other places (2, 9, 23). Thus, the age-specific incidence rate in the European born, in whom the risk of breast cancer is relatively high, is compatible with the bimodal curve observed in Western society, whereas in the Asian and African born the curve follows the postmenopausal plateau described in other low-risk population groups (9, 23). The contention is that early breast cancer appears to be associated with genetic components, whereas dietary factors (15), as well as obesity (9, 37), are associated with the development of the disease later in life.

One possible pathway for the role of diet in the development of breast cancer could be a change in the intestinal milieu by a low-fiber diet, as postulated for cancer of the colon, and an interplay between the concentration of bile degradation products and hormone metabolism. Since the epidemiology of both cancer of ovary (21) and of the corpus uteri (38) closely follows the breast cancer pattern, a similar underlying mechanism can be hypothesized.

Decreased fiber intake does not necessarily provide the sole explanation for a dietary factor in the etiology of any of the above-mentioned neoplasms in developed society. A higher fat consumption as suggested by other investigators (6, 12, 18, 20) may be explained through a similar model,
Table 2

Summary of significant differences in consumption of major food group in cancer cases and controls, by site

For source of data, see Refs. 26 and 28.

<table>
<thead>
<tr>
<th>Site</th>
<th>No. of case-control pairs</th>
<th>Food groups consumed more frequently, compared to both control groups</th>
<th>Food groups consumed less frequently, compared to both control groups</th>
<th>No. of items in group consumed more frequently</th>
<th>No. of items in group consumed less frequently</th>
<th>p (matched pairs)</th>
<th>p (items)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stomach</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cases compared to neighborhood controls</td>
<td>165</td>
<td>Starches</td>
<td>&lt;0.001</td>
<td>35</td>
<td>15</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>Cases compared to surgical controls</td>
<td>151</td>
<td>Starches</td>
<td>0.01</td>
<td>37</td>
<td>13</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>Colon</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cases compared to neighborhood controls</td>
<td>194</td>
<td>Fiber</td>
<td>&lt;0.001</td>
<td>12</td>
<td>61</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>Cases compared to surgical controls</td>
<td>170</td>
<td>Fiber</td>
<td>0.05</td>
<td>16</td>
<td>57</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>Rectum</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cases compared to neighborhood controls</td>
<td>76</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cases compared to surgical controls</td>
<td>69</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

since a high-fat diet leads to an increased excretion of bile acids and consequently to a larger content of substrate available for degradation (19). For a number of reasons an etiological role of a high-fat diet is even more tempting, since it would tie in some of the remaining high-risk cancer sites enumerated in Table 1, such as gallbladder or pancreas (14, 39) and possible even the kidney, where a good correlation between high-fat animal diet and incidence has recently been observed (40). It would also be consistent with the fact that fats constitute the major food group for which consumption is reported to be higher in the European-born Israeli, as compared to those of North African or Middle Eastern extraction (1).

Complexity of the Problem

At this stage we strongly feel that it would be unwarranted to incriminate a single dietary factor in the etiology of any malignant disorder. While the consumption of any individual food item or any group of food components may differ significantly between distinct population groups, the consumption of any given food category is probably always associated with a decreased consumption of other food combinations. Thus, the role of diet in carcinogenesis may in fact be related to an overall complex nutritional pattern rather than to selected items or food groups. If this contention is true it would easily explain the extreme variability of the results of dietary studies thus far. In addition to this underlying complexity of the problem, most, if not all, dietary studies are liable to the drawbacks of a retrospective approach. This is particularly crucial for cancer, where the prolonged latent period makes it virtually impossible to reconfirm the data in a prospective survey. The uncertainty in the determination of the point in time when the carcinogenic process begins further complicates the interpretation of retrospectively obtained dietary information, especially since nutritional patterns that are no longer adhered to must be recalled, and recent changes resulting from the disease itself must be differentiated.

These factors and many others may confound even further the results of dietary studies in Israel, where about 50% of the population is foreign born and has therefore undergone at least 1 major change in the dietary pattern over the life-span. A concurrent transition from one socioeconomic level to another has also contributed to both quantitative and qualitative shifts in nutritional pattern. Detailed period-by-period information must, therefore, be ascertained and evaluated.

To obtain meaningful data on the role of diet in carcinogenesis, one should look for consistent observations from a variety of populations studied under different methodology. Such consistency is thus far almost nonexistent. Further efforts should therefore be directed towards a comparative effort to untangle the complexity of the nutritional patterns that may be involved in carcinogenesis and to understand better the metabolic pathways inherent in the process.

References

B. Modan et al.

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